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REMEDIAL ACTION
SAMPLING AND ANALYSIS PLAN
PART II
QUALITY ASSURANCE PROJECT PLAN
VOLUME 1 - TEXT
REVISION: 2

ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

**REMEDIAL ACTION
SAMPLING AND ANALYSIS PLAN
PART II - QUALITY ASSURANCE PROJECT PLAN
VOLUME 1 - TEXT**

**ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

MARCH 24, 1992

REVISION: 2

**PREPARED FOR:
ENVIRO-CHEM TRUSTEES**

**PREPARED BY:
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PROJECT NO. 91104**

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QUALITY ASSURANCE PROJECT PLAN ENVIRO-CHEM SITE ZIONSVILLE, INDIANA

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- A. CompuChem Laboratories - Standard Operating Procedures and Other Information
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 - A.2 Standard Operating Procedure for 1,1-Dichloroethane Analysis
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- F. Field Equipment Standard Operating Procedures
 - F.1 Field Measurement of pH
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1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been developed and is being submitted in accordance with Exhibit A to the Consent Decree for the Remedial Action to be conducted at the Environmental Conservation and Chemical Corporation (Enviro-Chem) Site, located in Zionsville, Indiana. The Sampling and Analysis Plan for the site consists of the Part I - Field Sampling Plan (FSP) and this Part II - QAPP.

This QAPP presents the organization, objectives, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities associated with the sampling to be conducted as part of the remedial activities at the Enviro-Chem Site. The plan has been prepared in accordance with the U.S. Environmental Protection Agency (USEPA) document "Internal Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80), "Content Requirements for Quality Assurance Project Plans" prepared by Dr. Chen-Wen Tsai of USEPA Region V (undated), and the Region V "Model QAPP" (May 1991). In addition, the Data Quality Objectives (DQOs) were developed in accordance with the USEPA's "Data Quality Objectives for Remedial Response Activities" (March 1987).

The original draft of this QAPP, which was submitted to the USEPA on March 1, 1989, was previously revised to address comments provided by the USEPA in a letter dated April 19, 1991, and has now been revised to address USEPA comments provided in a letter dated February 21, 1992.

The site will be remediated under the terms of the Consent Decree. Exhibit A to the Consent Decree, the Remedial Action Plan, identifies the remediation activities to be conducted at the Enviro-Chem Site, which include the:

- Demolition and removal of containers and debris from the site;
- Installation and operation of an in situ soil vapor extraction (SVE) system;
- Installation of a cover in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA) Subtitle C (i.e., a RCRA-compliant cover);
- Implementation of access restrictions; and
- Monitoring of vapor, soil, and subsurface and surface water to evaluate the effectiveness of the remediation activities.

Each of these remediation activities is briefly described in Section 2.2 of the FSP and detailed in Exhibit A to the Consent Decree.

The sampling and analysis activities to be conducted at the site include the following:

- Analysis of extracted soil vapor for selected volatile organic compounds (VOCs) and phenol;

- Analysis of soil samples for selected VOCs, base neutral/acid organics (BNAs), and particle size distribution;
- Analysis of surface and subsurface water for selected VOCs, BNAs, and inorganics.

More details are given on sampling and analysis in the FSP and in later sections of the QAPP.

One or more contractors will be retained through competitive bidding by the Enviro-Chem Trustees to implement the remediation activities. The bid package is being submitted to the USEPA and the Indiana Department of Environmental Management (IDEM) concurrently with the FSP and the QAPP for the remediation sampling activities, and a Health and Safety Plan (HSP) for the water sampling activities. The contractor that will perform the water sample collection activities will be selected separately. The remediation contractor(s) will prepare and submit for USEPA's and IDEM's review and approval, one or more QAPPs and HSPs for the construction and operation activities, including, for the SVE system, the operation of an in-line air flow meter and an in-line indicator compound detector to signal the saturation of the first activated carbon column. (Note: The USEPA and IDEM will only review, not approve, the HSPs.) CompuChem Laboratories, Inc. (CompuChem); Lancaster Laboratories, Inc. (Lancaster); Industrial and Environmental Analysis, Inc. (IEA); Warzyn Engineering, Inc. (Warzyn - under subcontract to CompuChem); and EMS Heritage Laboratories, Inc. (EMS) have been selected to perform chemical analyses as part of the operational control of the remediation activities and the subsequent compliance monitoring. ATEC Associates, Inc. (ATEC) will perform particle size distribution analysis of soil samples collected during monitoring well and

piezometer installation. The specific analyses to be conducted by each laboratory are presented in Section 1.5.

1.2 Site Description

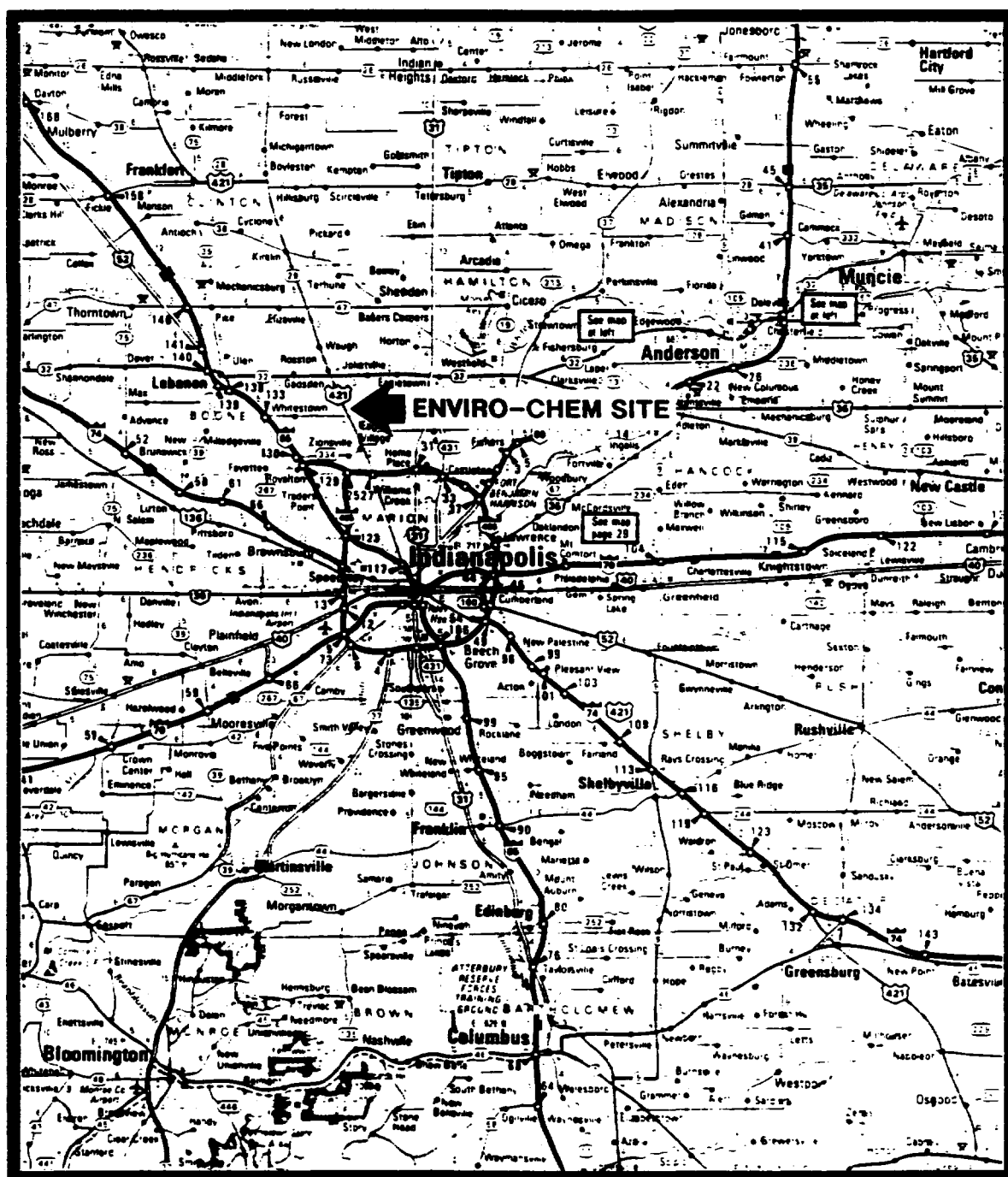
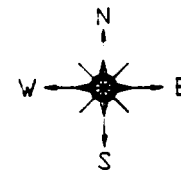
1.2.1 Location

The Enviro-Chem Site is located in Boone County, approximately 10 miles northwest of Indianapolis, on U.S. Highway 421 in Zionsville, Indiana (Figure 1-1). The site occupies 6.5 acres west of the Northside Sanitary Landfill (NSL), a closed solid waste disposal facility. The Enviro-Chem Site is also bounded on the south and east by NSL property. An unnamed ditch separates the two facilities along the eastern boundary. Several residential homes are located within one-half mile of the facility to the north and west (Figure 1-2).

1.2.2 Site History

In 1977, Enviro-Chem began operations at the site, which consisted of the recovery, reclamation, and brokering of primary solvents, oils, and other wastes. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Processes to reclaim solvents and oil included distillation, evaporation, and fractionation.

USEPA investigations concerning the accumulation of contaminated storm water on site, improper drum inventory, and several spill incidents lead to civil law suits, and finally the placement of Enviro-Chem into receivership in July 1981. Drum shipments to the site were halted in February 1982. Surface clean-up activities conducted by USEPA contractors during



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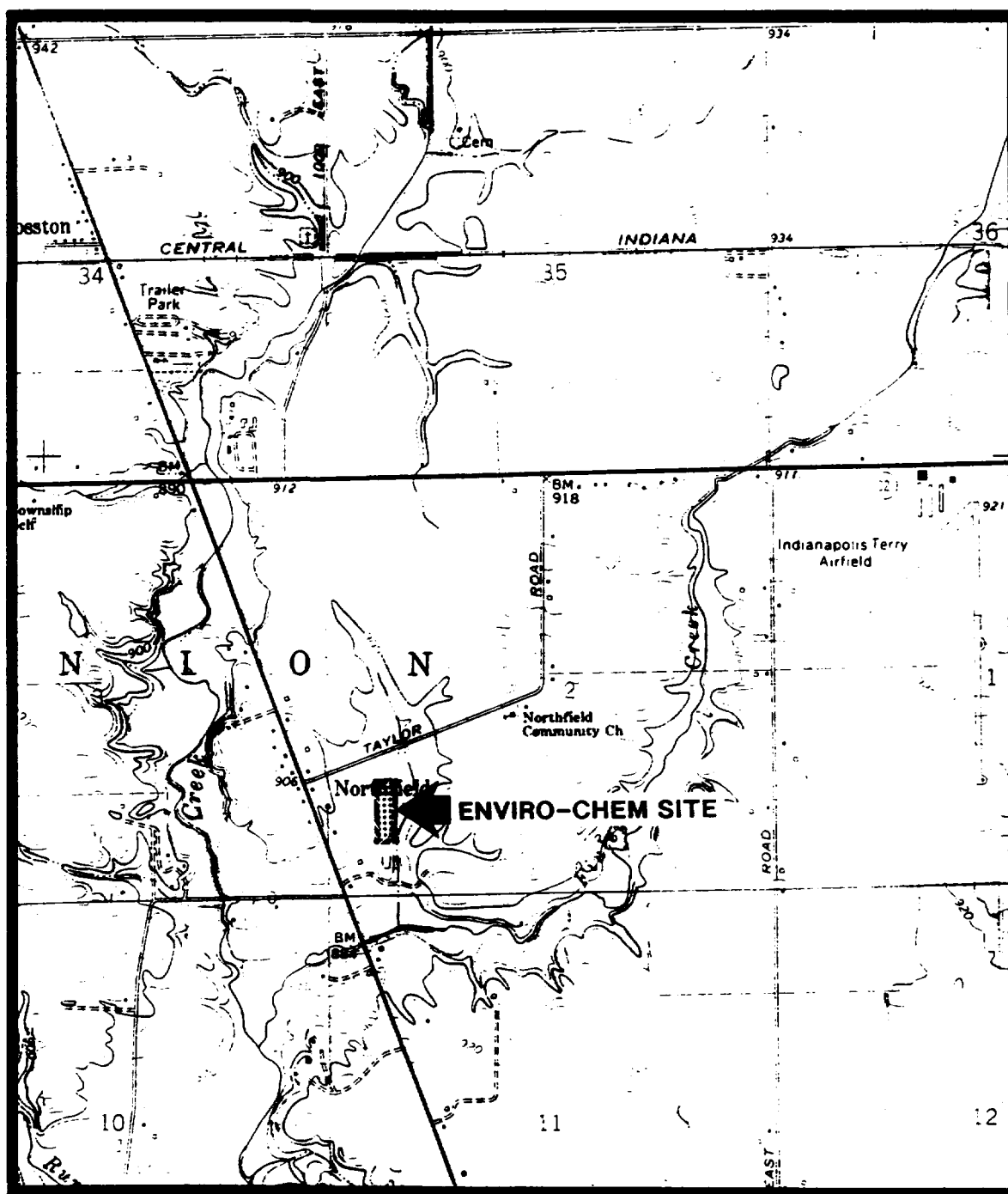
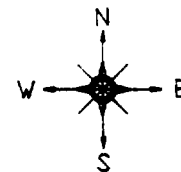
QUADRANGLE LOCATION

FIGURE 1-1
SITE LOCATION MAP
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA



PROJECT: 91104
 REPORT: QAPP
 DATE: 12/4/91
 CHECKED: MO
 REVIEWED: SHEA & GOULD

ROSSTON QUADRANGLE
INDIANA-BOONE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
1969



SCALE 1:24000
1 0.5 0 1 MILE
CONTOUR INTERVAL 10 FEET



QUADRANGLE LOCATION

FIGURE 1-2
SITE MAP
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA



PROJECT: 91104
REPORT: QAPP
DATE: 12/4/91
CHECKED: MO
APPROVED: SHEA & GOULD

1983 and 1984 included the removal of cooling pond waters, waste drums, tank wastes, contaminated soil, and cooling pond sludge.

A Remedial Investigation/Feasibility Study (RI/FS) was conducted by CH2M Hill for the USEPA from 1983 through 1986. A summary of the data gathered during the RI is presented in Table 1-1. The Record of Decision (ROD) for the site was published on September 25, 1987 and amended on June 7, 1991, and the Consent Decree for the remediation of the site was entered on September 10, 1991.

1.2.3 Geology and Hydrogeology

This section is adapted from the "Remedial Action Master Plan," prepared by CH2M Hill on March 31, 1983.

Union Township, the location of the Enviro-Chem Site, is included in the Tipton Till Plain physiographic unit as defined by Malott (1922). The Tipton Till Plain is an extensive flat to gently rolling area formed on a glacial drift deposited during the Wisconsin glacial advance.

About 180 feet of unconsolidated materials overlie bedrock at the site. These deposits are primarily Wisconsin Age glacial tills composed of silty clay, clayey silt, and sandy clay. The surficial glacial till is about 20,000 years old, and is part of the Cartersburg Till Member of the Trafalgar Formation (Wayne, 1963). According to West (1982), the glacial till present in the vicinity of the NSL is generally overconsolidated silty clay with a low permeability (10^{-8} to 10^{-9} cm/sec). The bedrock beneath the Enviro-Chem Site and the surrounding area consists of middle Devonian Age carbonates that dip gently to the southwest toward the Illinois basin.

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA ⁽¹⁾ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

(Page 1 of 6)

Parameter	Soil ⁽²⁾		Sediments		Subsurface Water		Off-Site Surface Water	
	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum (ug/l)	Maximum (ug/l)	Minimum (ug/l)	Maximum (ug/l)
VOLATILES								
Benzene					ND/4 J	9 K		
Chlorobenzene	ND/360	360						
1,1,1-Trichloroethane	ND/3 J	1,100,000			ND/5 K	7	ND/6	120
1,1-Dichloroethane	ND/380 J	380 J			ND/51.2	96	ND/45	45
1,1,2-Trichloroethane	ND/14	550						
Chloroethane					ND/29	120	ND/12	12
Chloroform	ND/5 J	2,900			ND/3 JB	9 K		
1,1-Dichloroethene	ND/47	35,000 B			ND/6	10		
Trans-1,2-Dichloroethene	ND/9	120,000 B			ND/3 J	4,000	ND/6 d	330
Trans-1,3-Dichloropropene					ND/77.5	77.5		
Ethyl Benzene	ND/14	1,500,000			ND/3 J	9 K	ND/2 d	13 d
Methylene Chloride	ND/8	310,000	ND/6.1	9.1	ND/2 J	64	ND/3 d	86
Trichlorofluoromethane			ND	ND	ND	ND		
Tetrachloroethene	ND/5 J	650,000			ND/9 K	9 K	ND/5 d	29
Toluene	ND/6	2,000,000			ND/9 K	9 K	ND/6	82
Trichloroethene	ND/3 J	4,800,000 B			ND/3 J	28,000	ND/13	240

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA⁽¹⁾
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 2 of 6)

Parameter	Soil ⁽²⁾		Sediments		Subsurface Water		Off-Site Surface Water	
	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum (ug/l)	Maximum (ug/l)	Minimum (ug/l)	Maximum (ug/l)
VOLATILES (continued)								
Vinyl Chloride	ND/7	7			ND/6	85.8	ND/10	11
Acetone	ND/16	650,000			ND/9 KB	15,030 B	ND/30	1,100
2-Butanone	ND/6 J	2,800,000			ND/9 K	26 B	ND/16	560
4-Methyl-2-Pentanone	ND/35 J	190,000						
Styrene					ND/5 K	5 K		
o-Xylene							ND	ND
Total Xylenes	ND/11	6,800,000			ND/9	12	ND/11	47
ACID EXTRACTABLES								
p-Chloro-m-Cresol							ND/30 d,e	30 d,e
Phenol	ND/610	570,000					ND/92 e	92 e
2-Methylphenol	ND/340	340					ND/27 e	27 e
4-Methylphenol	ND/53,000	53,000					ND/89 e	120 e
BASE/NEUTRALS								
1,2-Dichlorobenzene	ND/240	900,000						
Fluoranthene					ND/20 K	20 K		
Isophorone	ND/270	440,000			ND/20 K	20 K	ND/86 e	ND/240 e

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA ⁽¹⁾

ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

(Page 3 of 6)

Parameter	Soil ⁽²⁾		Sediments		Subsurface Water		Off-Site Surface Water	
	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum (ug/l)	Maximum (ug/l)	Minimum (ug/l)	Maximum (ug/l)
BASE/NEUTRALS (continued)								
Naphthalene	ND/640	180,000						
bis(2-Ethylhexyl)phthalate	ND/230	370,000	ND/912	912	ND/23 K	23 K	ND	ND
Butyl Benzyl Phthalate	ND/400 J	47,000						
Di-n-Butyl Phthalate	ND/53	8,200						
Di-n-Octyl Phthalate	ND/310	2,100					ND/17 d,e	17 d,e
Diethyl Phthalate	ND/1,200	9,000			ND/20 K	20 K		
Dimethyl Phthalate	ND/360 J	1,300						
Crysene					ND/20 K	20 K		
Fluorene	ND/260	260						
Phenanthrene	ND/350	8,100						
Pyrene					ND/30	30		
2-Methylnaphthalene	ND/1,900	2,100						
PCB-1232	ND/340 C	540 C						
PCB-1260	ND/750	39,000						
INORGANICS								
Aluminum	1,920	44,800	2,172	9,744	ND/[65]	61,500	ND/[69]a	3,050 a
Antimony	ND/42	42	ND	ND	ND/4	4	ND	ND

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA⁽¹⁾
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 4 of 6)

Parameter	Soil ⁽²⁾		Sediments		Subsurface Water		Off-Site Surface Water	
	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum (ug/l)	Maximum (ug/l)	Minimum (ug/l)	Maximum (ug/l)
INORGANICS (continued)								
Arsenic	ND/[4.5]	20	ND	ND	ND/15	15	ND	ND
Barium	[27]	1,730	27	102	150	1,070	ND/[92]	180
Beryllium	ND/[.36]	[3.9]	ND/0.6	0.6	ND	ND	ND	ND
Cadmium	ND/2.9	27	1.3 c	2.3	ND	ND	ND	ND
Calcium	[2,500]*	1,260,000	N/A	N/A	70,240 E	161,100 E	N/A	N/A
Chromium	9.6	145*	4	13	ND/11	144	ND/15	15
Cobalt	[3.4]	[51]	ND/5.3	5.3	ND/80	80	ND	ND
Copper	[13]	167	7	23	ND/[16]	106	ND/[18]	[18]
Iron	11,900	147,000	8,598	18,696	[51]	105,000	[77]	4,460
Lead	4.5	432*	6.8	31.3	ND/6.5	102	ND	ND
Magnesium	[2,060]*	292,000	N/A	N/A	29,780 E	131,800 E	N/A	N/A
Manganese	158	6,870	161	499	ND/17	1,930	76	1,708
Mercury	ND	ND	ND/0.05	2.25	ND/0.2	0.4	ND/0.2 b	0.4 b
Nickel	[5.8]	37	ND/13	23	ND/[32]	176	ND/[21]	47
Potassium	ND/[905]	[10,500]	N/A	N/A	ND/[1195]	105,940	N/A	N/A

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA⁽¹⁾
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 5 of 6)

Parameter	Soil ⁽²⁾		Sediments		Subsurface Water		Off-Site Surface Water	
	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum ⁽³⁾	Maximum ⁽³⁾	Minimum (ug/l)	Maximum (ug/l)	Minimum (ug/l)	Maximum (ug/l)
INORGANICS (continued)								
Selenium	ND	ND	ND	ND	ND/3	4	ND/6	6
Silver	ND/[3.3]	[3.8]	ND	ND	ND/14	33	ND/[9.2]	9.2
Sodium	ND/[480]	[15,600]	N/A	N/A	10,060	380,700	N/A	N/A
Thallium	ND	ND	ND	ND	ND/0.4	0.4	ND	ND
Tin	ND/17	30	ND	ND	ND	ND	ND	ND
Vanadium	[15]	37	ND/23	23	ND	ND	ND	ND
Zinc	[38]	650*	ND/52	75	ND/11	276	ND/36 B	79 B
Cyanide	ND/0.8	4.4	ND/33	73	ND	ND	ND/0.005	0.013

Notes:

- (1) These data were obtained from the tables of analytical results presented in Section 4.0 of the RI Report by CH2M Hill, dated March 14, 1986.
- (2) The ranges given for soil are taken from the Phase II data only, since some soil was removed from the site after the Phase I analyses.
- (3) The units for the soil and sediment analyses are: ug/kg for volatiles, acid extractables, base neutrals, and PCBs/pesticides results; and mg/kg for the inorganics results.

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA⁽¹⁾

ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

(Page 6 of 6)

Key:

- * The duplicate analysis was not within control limits.
- [] The value was less than the Contract Required Detection Limit.
- B The analyte was found in the laboratory blank and in the sample, which indicates probable contamination.
- C The identification of this polychlorinated biphenyl (PCB)/pesticide parameter has not been confirmed by gas chromatography/mass spectrometry (GC/MS).
- J The value is estimated and occurs when the mass spectra data indicate the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
- E The value is estimated or not reported because of the presence of interferences.
- K The actual value, within the limits of the method, is less than the value given.
- a There was a poor or marginal recovery of this spiked metal.
- b This metal was also detected in the analysis of the field blank.
- c This value should be regarded as a qualitative indication of the presence of these metals because the concentration is below the lowest quantitative standard.
- d An estimated value.
- e The Quality Assurance (QA) review identified the results as semiquantitative because the average surrogate recovery was < 40 percent.
- ND The compound was not detected. A number after ND in the "Minimum" column is the lowest detected concentration of the compound. For example, "ND/6" means that the compound was not detected in some samples and that the lowest detected concentration was 6.
- N/A The compound was not analyzed for.
A blank space in the table indicates that no analytical results were given in the Remedial Investigation Report for that compound in that matrix. The compound was either not analyzed for or not detected.

Scattered intertill deposits of sand, gravel, and silty sand are present at varying elevations in the area. These permeable materials are apparently of glaciofluvial origin and, with the exception of significant sand and gravel deposits occurring at a depth of about 160 feet, are thin, confined in nature, and laterally discontinuous. In the area surrounding the site, residential wells primarily obtain water from the sand and gravel zones in the glacial drift. These residential wells are generally 100 to 170 feet deep, but several are located in aquifers only 40 to 50 feet below the ground surface. The subsurface water apparently affected by the previous site activities is located at a maximum depth of 15 feet.

The upper aquifer subsurface water beneath the site area apparently flows to the southeast toward Finley Creek. This creek converges with the unnamed ditch, flowing south along the eastern site boundary, at a location about 1,000 feet downstream from the Enviro-Chem Site. Finley Creek may be acting as a local migration feature because the subsurface water gradient on the eastern side of the creek is to the northwest toward the creek.

1.3 Project Objectives

The objectives of the remediation activities at the Enviro-Chem Site are to:

- Extract, concentrate, and destroy organic compounds by using an in situ SVE system;
- Enhance the operation of the SVE system and minimize the migration of the compounds remaining in the soils by installing a RCRA-compliant cover; and

- Monitor the effectiveness of the remediation activities by collecting subsurface and surface water, soil, and vapor samples.

1.4 Sample Network Design and Rationale

The sample network design and rationale are presented in Section 4.0 of the FSP. With the exception of the background water samples, the sampling locations and frequency for all media to be sampled during the remediation activities (extracted soil vapor, soil, and subsurface and surface water) are specified in Exhibit A to the Consent Decree.

1.5 Parameters To Be Tested and Frequency

Table 1-2 presents a summary of the investigative and QC samples to be collected, and Table 1-3 specifies the laboratories that will perform each of the analyses. Tables 1-4 through 1-7 indicate the parameters to be analyzed in each sampling matrix and the Acceptable Concentrations in each medium as defined in Exhibit A to the Consent Decree.

1.6 Data Quality Objectives and Intended Data Uses

DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions made during site remediation activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels that address various data uses and the QA/QC efforts and methods required to achieve the desired level of quality. These levels are:

TABLE 1-2[illegible]

TABLE 1-2

**SUMMARY OF INVESTIGATIVE AND QUALITY CONTROL SAMPLES TO BE COLLECTED
 ENVIRO-CHEM SITE
 ZIONSVILLE, INDIANA
 (Page 2 of 4)**

Sample Matrix	Field Parameters	Laboratory Parameters ⁽¹⁾	Investigative Samples ⁽²⁾			Field QA/QC Samples ⁽³⁾									Total
						Field Duplicate			Field Blanks			MS/MSD ^(4,5)			
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Surface Water ⁽⁶⁾	pH Specific Conductance Temperature	Volatiles	2	18	36	1	18	18	1	18	18	1	18	18	90
		BNAs	2	18	36	1	18	18	1	18	18	1	18	18	90
		PCBs	2	18	36	1	18	18	1	18	18	1	18	18	90
		Chromium VI	2	18	36	1	18	18	1	18	18	--	--	--	72
		Arsenic	2	18	36	1	18	18	1	18	18	--	--	--	72
		Other Metals	2	18	36	1	18	18	1	18	18	--	--	--	72
		Cyanide	2	18	36	1	18	18	1	18	18	--	--	--	72
Additional Off-Site Background Subsurface Water from Investigative Upgradient Wells ^(6,7,9)	pH Specific Conductance Temperature	1,1-DCA	2	1	2	--	--	--	--	--	--	--	--	--	2
		Other Volatiles	2	1	2	--	--	--	--	--	--	--	--	--	2
		BNAs	2	1	2	--	--	--	--	--	--	--	--	--	2
		PCBs	2	1	2	--	--	--	--	--	--	--	--	--	2
		Chromium VI	2	1	2	--	--	--	--	--	--	--	--	--	2
		Tin	2	1	2	--	--	--	--	--	--	--	--	--	2
		Antimony	2	1	2	--	--	--	--	--	--	--	--	--	2
		Other Metals	2	1	2	--	--	--	--	--	--	--	--	--	2
Cyanide	2	1	2	--	--	--	--	--	--	--	--	--	2		
Additional Background Surface Water from Investigative Upstream Location ^(6,9)	pH Specific Conductance Temperature	Volatiles	1	1	1	--	--	--	--	--	--	--	--	--	1
		BNAs	1	1	1	--	--	--	--	--	--	--	--	--	1
		PCBs	1	1	1	--	--	--	--	--	--	--	--	--	1
		Chromium VI	1	1	1	--	--	--	--	--	--	--	--	--	1
		Arsenic	1	1	1	--	--	--	--	--	--	--	--	--	1
		Other Metals	1	1	1	--	--	--	--	--	--	--	--	--	1
		Cyanide	1	1	1	--	--	--	--	--	--	--	--	--	1
Soil from Monitoring Well and Piezometer Borings	--	Particle Size	15	1	15	2	1	2	--	--	--	--	--	--	17

TABLE 1-2

**SUMMARY OF INVESTIGATIVE AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 3 of 4)**

Sample Matrix	Field Parameters	Laboratory Parameters ⁽¹⁾	Investigative Samples ⁽²⁾			Field QA/QC Samples ⁽³⁾									Total
						Field Duplicate			Field Blanks			MS/MSD ^(4,5)			
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Subsurface Water from Background-Only Wells ^(7,9,10)	pH Specific Conductance Temperature	1,1-DCA	2	6	12	1	1	1	1	1	1	1	1	1	15
		Other Volatiles	2	6	12	1	1	1	1	1	1	1	1	1	15
		BNAs	2	6	12	1	1	1	1	1	1	1	1	1	15
		PCBs	2	6	12	1	1	1	1	1	1	1	1	1	15
		Chromium VI	2	6	12	1	1	1	1	1	1	—	—	—	14
		Tin	2	6	12	1	1	1	1	1	1	—	—	—	14
		Antimony	2	6	12	1	1	1	1	1	1	—	—	—	14
		Other Metals	2	6	12	1	1	1	1	1	1	—	—	—	14
		Cyanide	2	6	12	1	1	1	1	1	1	—	—	—	14
Surface Water from Background-Only Location ^(6,9,10)	pH Specific Conductance Temperature	Volatiles	1	6	6	1	1	1	1	1	1	1	1	1	9
		BNAs	1	6	6	1	1	1	1	1	1	1	1	1	9
		PCBs	1	6	6	1	1	1	1	1	1	1	1	1	9
		Chromium VI	1	6	6	1	1	1	1	1	1	—	—	—	8
		Arsenic	1	6	6	1	1	1	1	1	1	—	—	—	8
		Other Metals	1	6	6	1	1	1	1	1	1	—	—	—	8
		Cyanide	1	6	6	1	1	1	1	1	1	—	—	—	8

Notes:

⁽¹⁾See Tables 4-1, 4-3, 4-4, and 4-5 of the FSP for the specific analytical parameters to be analyzed for each matrix.

⁽²⁾The number of investigative samples depends on the duration of the SVE system operation. The numbers shown assume one year of operation and seven years of on- and off-site monitoring. See Section 4.0 of the FSP for a description of the frequency of sample collection per matrix.

⁽³⁾The field Quality Assurance/Quality Control (QA/QC) samples also include trip blanks, which are required for volatile organics samples. One trip blank, consisting of two 40-ml glass vials filled with organic-free, deionized water, will be included with each shipping container of volatile organic samples. The media used for field blanks is organic-free, deionized water. Trip blanks for the extraction trench vapor sampling for volatile organic compound (VOC) analysis will consist of one unbroken sampling tube per shipment.

⁽⁴⁾Collection of matrix spike/matrix spike duplicate (MS/MSD) samples are required only for organic analysis of water samples. Triple the normal sample volume will be collected for 1,1-DCA and other volatiles analyses, and double the normal volumes will be collected for BNAs and PCBs.

different

TABLE 1-2

**SUMMARY OF INVESTIGATIVE AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 4 of 4)**

⁽⁹⁾For inorganics, organics in soil, and soil vapor analyses, no extra sample volume is required.

⁽¹⁰⁾Sampling of on- and off-site subsurface water will be conducted simultaneously. With the exception of the 1,1-DCA, tin, and antimony analyses, for which the QA/QC samples are included with the on-site subsurface water samples, the field duplicate and blank samples for this matrix are included in the number of QA/QC samples shown for off-site subsurface water sampling.

⁽¹¹⁾Subsurface samples for inorganics and PCBs analyses will be filtered.

⁽¹²⁾The MS/MSD sample for 1,1-DCA analysis is included with the on-site subsurface water samples.

⁽¹³⁾Since the collection of additional subsurface and surface water background samples will coincide with the collection of samples from "background-only" locations, the QA/QC samples identified for the background-only locations will cover all of the background subsurface and surface water samples.

⁽¹⁴⁾Since five of the background-only sampling events will coincide with the quarterly investigative sampling, no additional QA/QC samples are needed for those events.

Key:

1,1-DCA = 1,1-Dichloroethane

BNAs = Base Neutral/Acids

PCBs = Polychlorinated Biphenyls

TABLE 1-3

**PARAMETERS TO BE ANALYZED BY EACH LABORATORY
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Sample Matrix	Laboratory Parameter⁽¹⁾	Laboratory Conducting the Analysis
Soil Vapor	Volatiles Phenol	Lancaster Laboratories Lancaster Laboratories
Soil	Volatiles Phenol Particle Size	CompuChem Laboratories CompuChem Laboratories ATEC Associates
On-site Subsurface Water and Background-Only Subsurface water	1,1-DCA Other Volatiles BNAs PCBs Chromium VI Tin Antimony Other Metals Cyanide	CompuChem Laboratories CompuChem Laboratories CompuChem Laboratories CompuChem Laboratories EMS Heritage Laboratories Warzyn Engineering, Inc. IEA, Inc. CompuChem Laboratories CompuChem Laboratories
Surface Water and Investigative-Only Subsurface Water	Volatiles BNAs PCBs Chromium VI Arsenic Other Metals Cyanide	CompuChem Laboratories CompuChem Laboratories CompuChem Laboratories EMS Heritage Laboratories IEA, Inc. CompuChem Laboratories CompuChem Laboratories
Off-site Background/Investigative Subsurface Water (1st year only)	1,1-DCA Other Volatiles BNAs PCBs Chromium VI Tin Arsenic, Antimony Other Metals Cyanide	CompuChem Laboratories CompuChem Laboratories CompuChem Laboratories CompuChem Laboratories EMS Heritage Laboratories Warzyn Engineering, Inc. IEA, Inc. CompuChem Laboratories CompuChem Laboratories

Note:

- ⁽¹⁾ The specific parameters to be analyzed for each matrix are listed in Tables 1-4 through 1-7.

Key:

1,1-DCA = 1,1-Dichloroethane
 BNAs = Base Neutral/Acids
 PCBs = Polychlorinated Biphenyls

TABLE 1-4

**SOIL VAPOR CONCENTRATIONS IN EQUILIBRIUM
WITH ACCEPTABLE SOIL CONCENTRATIONS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Parameter⁽¹⁾	Soil Vapor Concentration ⁽²⁾ (ppm by volume)
Volatile Organics:	
Acetone	254
Chloroform	496
1,1-Dichloroethane	3.4
1,1-Dichloroethene	515
Ethyl Benzene	9,316
Methylene Chloride	22.4
Methyl Ethyl Ketone	13
Methyl Isobutyl Ketone	233
Tetrachloroethene	16.8
Toluene	36,556
1,1,1-Trichloroethane	2,819
1,1,2-Trichloroethane	1.1
Trichloroethene	71.5
Total Xylenes	4,794
Base Neutral/Acid Organics:	
Phenol	1.4

Notes:

⁽¹⁾Compounds detected in the soils at least once during the Remedial Investigation at concentrations above the Acceptable Soil Concentrations listed in Table 3-1 of Exhibit A to the Consent Decree.

⁽²⁾From Table 4-1 of Exhibit A to the Consent Decree.

TABLE 1-5

**ACCEPTABLE SOIL CONCENTRATIONS⁽¹⁾
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Parameter	Acceptable Soil Concentration (ug/kg)
Volatile Organics:	
Acetone	490
Chlorobenzene	10,100
Chloroform	2,300
1,1-Dichloroethane	5.7
1,1-Dichloroethene	120
Ethyl Benzene	234,000
Methylene Chloride	20
Methyl Ethyl Ketone	75
Methyl Isobutyl Ketone	8,900
Tetrachloroethene	130
Toluene	238,000
1,1,1-Trichloroethane	7,200
1,1,2-Trichloroethane	22
Trichloroethene	240
Total Xylenes	195,000
Base Neutral/Acid Organics:	
Phenol	9,800

Note:

⁽¹⁾From Table 3-1 of Exhibit A to the Consent Decree.

TABLE 1-6

**ON-SITE TILL WATER
ACCEPTABLE SUBSURFACE WATER CONCENTRATIONS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 1 of 2)**

Parameter	Acceptable Subsurface Water Concentration ⁽¹⁾ (ug/l)
Volatile Organics:	
Acetone	3,500
Chlorobenzene	60
Chloroform	100
1,1-Dichloroethane	0.38
1,1-Dichloroethene	7
Ethyl Benzene	680
Methylene Chloride	4.7
Methyl Ethyl Ketone	170
Methyl Isobutyl Ketone	1,750
Tetrachloroethene	0.69
Toluene	2,000
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	0.61
Trichloroethene	5
Total Xylenes	440
Base Neutral/Acid Organics:	
Bis(2-ethylhexyl)phthalate	2.5
Di-n-Butyl Phthalate	3,500
Diethyl Phthalate	28,000
Isophorone	8.5
Naphthalene	14,000
Phenol	1,400

TABLE 1-6
ON-SITE TILL WATER
ACCEPTABLE SUBSURFACE WATER CONCENTRATIONS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 2 of 2)

Parameter	Acceptable Subsurface Water Concentration ⁽¹⁾ (ug/l)
Inorganics⁽²⁾:	
Antimony	14
Arsenic	50
Barium	1,000
Beryllium	175
Cadmium	10
Chromium VI	50
Lead	50
Manganese	7,000
Nickel	150
Silver	50
Tin	21,000
Vanadium	245
Zinc	7,000
Cyanide	154
Polychlorinated Bipheynls (PCBs)⁽²⁾:	0.0045⁽³⁾

Notes:

⁽¹⁾From Table 3-1 of Exhibit A to the Consent Decree.

⁽²⁾Dissolved, except for cyanide.

⁽³⁾The Acceptable Subsurface Water Concentration shown is for the sum of all PCBs present.

TABLE 1-7

**OFF-SITE SUBSURFACE WATER AND SURFACE WATER
ACCEPTABLE STREAM CONCENTRATIONS**

**ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Parameter	Acceptable Stream Concentration⁽¹⁾ (ug/l)
Volatile Organics:	
Chloroform	15.7
1,1-Dichloroethene	1.9
Ethyl Benzene	3,280
Methylene Chloride	15.7
Tetrachloroethene	8.9
Toluene	3,400
1,1,1-Trichloroethane	5,280
1,1,2-Trichloroethane	41.8
Trichloroethene	80.7
Base Neutral/Acid Organics:	
Bis(2-ethylhexyl)phthalate	50,000
Di-n-Butyl Phthalate	154,000
Diethyl Phthalate	52,100
Naphthalene	620
Phenol	570
Inorganics⁽²⁾:	
Arsenic	0.0175
Chromium VI	11
Lead	10
Nickel	100
Zinc	47
Cyanide	5.2
Polychlorinated Biphenyls (PCBs)⁽²⁾:	0.000079 ⁽³⁾

Notes:

⁽¹⁾From Table 3-1 of Exhibit A to the Consent Decree.

⁽²⁾Dissolved (except for cyanide) for subsurface water.

⁽³⁾The Acceptable Stream Concentration shown is for the sum of all PCBs present.

- **Screening (DQO Level 1):** This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at a site, preliminary comparison of site data to Applicable or Relevant and Appropriate Requirements (ARARs), initial site characterization to locate areas that require subsequent and more accurate analyses, and engineering screening of alternatives (bench-scale tests).
- **Field Analyses (DQO Level 2):** This provides rapid results and better quality than Level 1 analyses. This level may include mobile laboratory-generated data depending on the level of quality control exercised.
- **Engineering (DQO Level 3):** This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile laboratory-generated data and some analytical laboratory methods (e.g., laboratory data with quick turnaround used for screening but without full QC documentation).
- **Conformational (DQO Level 4):** This provides the highest level of data quality and is used for the purposes of conducting a risk assessment, evaluating remedial alternatives, and determining the Potentially Responsible Parties. These analyses require full Contract Laboratory Program (CLP) analytical methods and data

validation procedures in accordance with USEPA-recognized protocols.

- **Nonstandard (DQO Level 5):** This refers to analyses by nonstandard protocols, for example, when exact detection limits or the analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

The primary data uses for the Enviro-Chem Site sampling are to assess the effectiveness of the remediation activities; however, some of the data will be used for health and safety purposes (i.e., to establish the level of protection needed for water sampling activities at the site). Table 1-8 provides a summary of the DQOs and intended data uses for each sample type to be collected at the site.

1.7 Project Schedule

The anticipated schedule for completion of the remediation activities at the Enviro-Chem Site is presented in Figure 1-3.

TABLE 1-8

DATA QUALITY OBJECTIVES AND INTENDED DATA USES
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 1 of 2)

Data Collected	Data Quality Objective⁽¹⁾	Intended Data Use
Combined Extracted Soil Vapor - Volatile Organics - Phenol	Level V Level V	Demonstrate compliance with the Soil Vapor Criterion for Soil Clean-up Verification, as specified in Section 4.2 of Exhibit A to the Consent Decree.
Individual Extraction Trenches Soil Vapor - Volatile Organics - Phenol	Level V Level V	Evaluate the completeness of vapor extraction activities and determine the time for initiation of the "restart spikes," as specified in Section 4.2 of Exhibit A to the Consent Decree.
Soil Samples - Volatile Organics - Phenol	Level V Level IV	Demonstrate compliance with the Soil Sample Criterion for Soil Clean-up Verification, as specified in Exhibit A to the Consent Decree.
On-Site Subsurface Water - CLP Parameters ⁽²⁾ - 1,1-DCA - Tin - Cr VI - Antimony	Level IV Level V Level V Level V Level V	(1) Demonstrate compliance with the On-Site Till Water Criterion for Soil Clean-up Verification, as specified in Section 4.2 of Exhibit A to the Consent Decree; and (2) demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after the soil vapor extraction is completed.
Off-Site Subsurface Water - CLP Parameters ⁽²⁾ - 1,1-DCA - Tin - Cr VI - Arsenic - Antimony	Level IV Level V Level V Level V Level V Level V	(1) Demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after the soil vapor extraction is completed; and (2) determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Surface Water - CLP Parameters ⁽²⁾ - Cr VI - Arsenic	Level IV Level V Level V	(1) Demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after soil vapor extraction is completed; and (2) determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.
Additional Off-Site Background Subsurface Water from Investigative Upgradient Wells - CLP Parameters ⁽²⁾ - 1,1-DCA - Tin - Cr VI - Antimony	Level IV Level V Level V Level V Level V	Determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Additional Background Surface Water from Investigative Upstream Location - CLP Parameters ⁽²⁾ - Cr VI - Arsenic	Level IV Level V Level V	Determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.

TABLE 1-8

DATA QUALITY OBJECTIVES AND INTENDED DATA USES
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
 (Page 2 of 2)

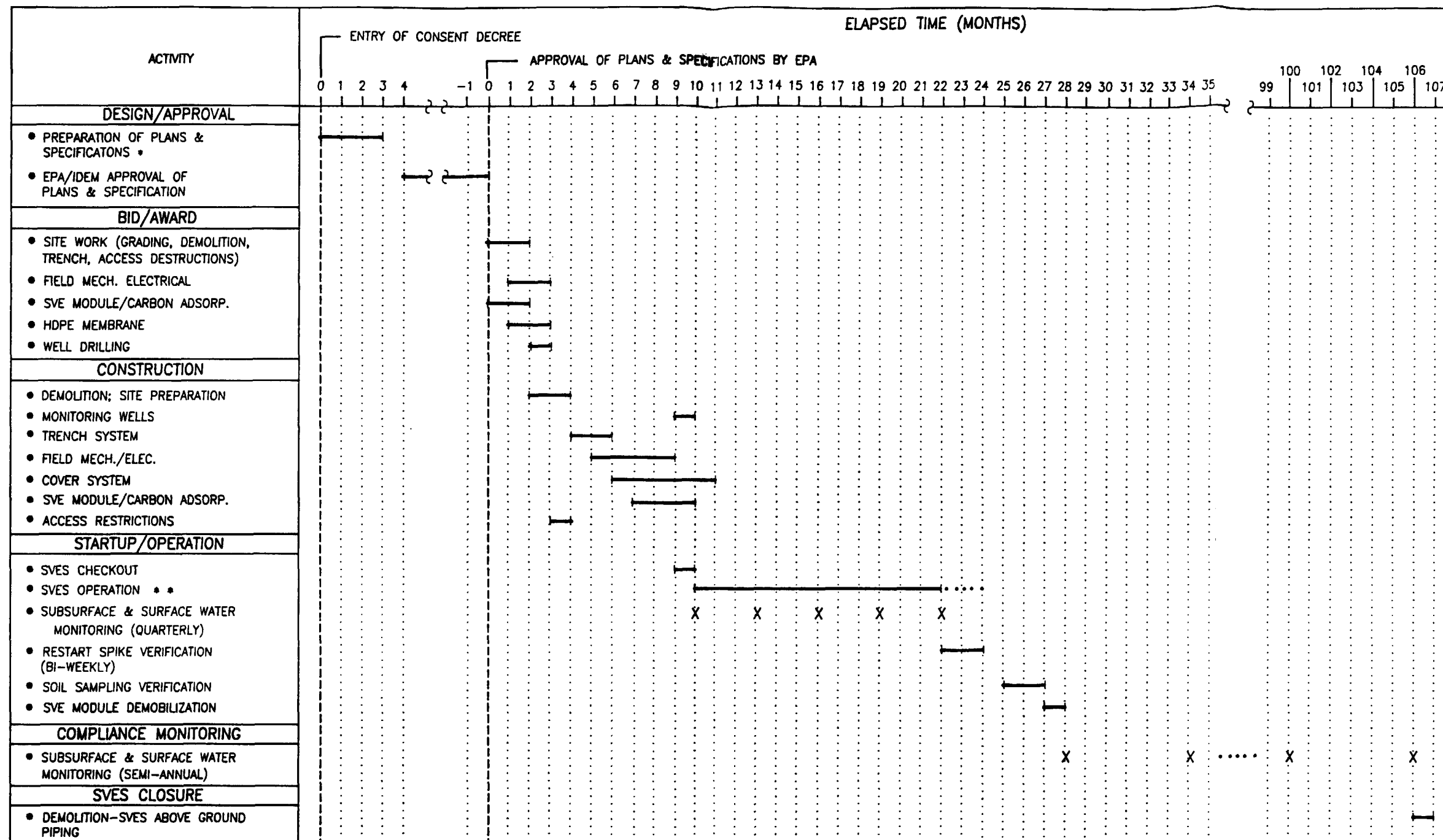
Data Collected	Data Quality Objective⁽¹⁾	Intended Data Use
Soil from Monitoring Well and Piezometer Borings - Particle Size	Level III	Determine the hydraulic conductivity of the water bearing units at the locations of the monitoring wells and piezometer.
Subsurface Water from Background-Only Wells - CLP Parameters ⁽²⁾ - 1,1-DCA - Tin - Cr VI - Antimony	Level IV Level V Level V Level V Level V	Determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Surface Water from Background-Only Location - CLP Parameters ⁽²⁾ - Cr VI - Arsenic	Level IV Level V Level V	Determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.
Subsurface Water - Water Level	Level I	Predict ground water flow rates and direction to assist in prediction of parameter migration velocity and direction.
Field Water Data - Temperature - pH - Specific Conductance	Level II Level II Level II	Determine whether subsurface water has stabilized in the monitoring wells, to provide a comparison with previous samplings and to aid in characterizing the water quality.
Field Ambient Air - Organics Vapors	Level II	Determine the level of respiratory protection required during sampling activities at the site. Because this equipment is used only for health and safety purposes, information on its use is included in the Health and Safety Plan. No further details are given in this QAPP.

Note:

- ⁽¹⁾ Based on "Data Quality Objectives for Remedial Response Activities" - EPA 540/6-87/003, March 1987.
- ⁽²⁾ Only the parameters shown in Table 1-4 through 1-7 which are not otherwise listed on this table will be analyzed using the CLP protocols as modified on Appendix A.8.

Key:

1,1-DCA = 1,1-Dichloroethane
 Cr VI = Chromium VI
 CLP = Contract Laboratory Program protocols
 QAPP = Quality Assurance Project Plan



NOTES TO FIGURE 5-1

- SVES SOIL VAPOR EXTRACTION SYSTEM
- PLANS & SPECIFICATIONS: (1) DRAWINGS & SPECIFICATIONS FOR CONSTRUCTION
(2) HEALTH & SAFETY PLAN
(3) QUALITY ASSURANCE PROJECT PLAN
(4) FIELD SAMPLING PLAN

** SCHEDULE ASSUMES 12 MONTH OPERATION OF SVES. ACTUAL PERIOD OF OPERATION COULD BE SHORTER OR LONGER DEPENDING ON PERFORMANCE OF SVES. THE SCHEDULE FOR EACH ACTIVITY LISTED BELOW "SVES OPERATION" WILL BE ADJUSTED ACCORDINGLY AS DESCRIBED IN SECTION 4.0 OF EXHIBIT A.

FIGURE 1-3
REMEDIAL SCHEDULE
IMPLEMENTATION SCHEDULE
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA



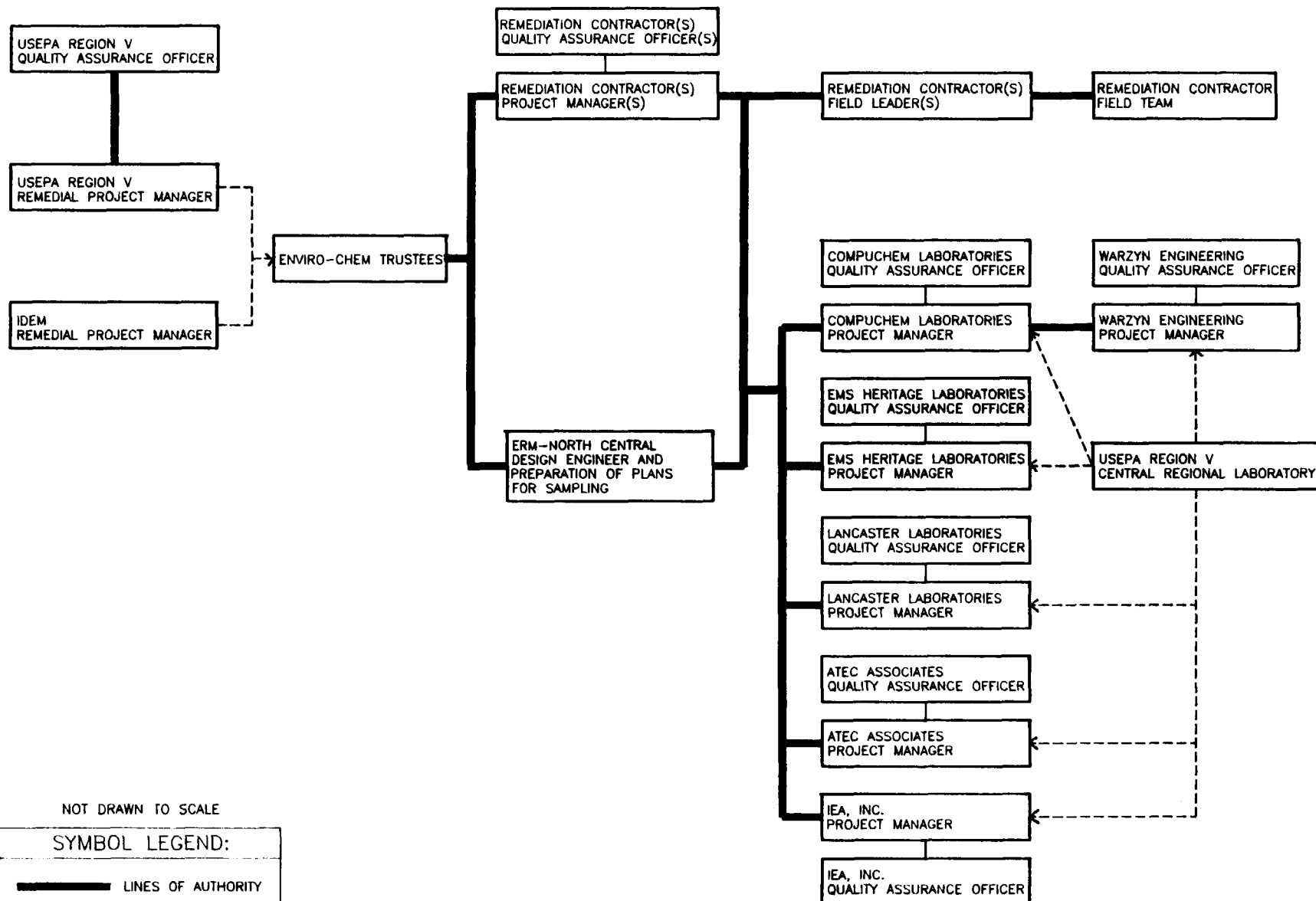
2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The USEPA and IDEM will be responsible for the government reviews associated with this Remedial Action. The Enviro-Chem Trustees will have the overall responsibility for implementing the Remedial Action at the site. Environmental Resources Management-North Central, Inc. (ERM-North Central) is responsible for the preparation of the bid package, the FSP and the QAPP for the remediation sampling activities, as well as the HSP for the water sampling activities. The remediation contractor(s) will prepare one or more QAPPs and HSPs for the construction activities. The various QA and management responsibilities of key project personnel are defined in the following subsections. A project organization chart, which includes the lines of authority, is included as Figure 2-1.

Enviro-Chem Trustees

The Enviro-Chem Trustees will have the overall responsibility for the implementation of the Remedial Action at the Enviro-Chem Site. The Enviro-Chem Trustees have the authority to commit the resources necessary to meet the project objectives and requirements.

The Enviro-Chem Trustees will: (1) provide the major point of contact with the USEPA and IDEM for matters concerning the project, (2) ensure that the project activities meet the requirements of the Consent Decree, and (3) approve all external reports (deliverables) before their submission to the agencies.



NOT DRAWN TO SCALE

SYMBOL LEGEND:

- LINES OF AUTHORITY
- ADVISING ROLE
- OVERSIGHT ROLE

FIGURE 2-1

**ORGANIZATION CHART AND LINES OF AUTHORITY
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**



USEPA Remedial Project Manager

Ms. Karen Vendl, the USEPA Remedial Project Manager (RPM), will be responsible for overseeing the project and coordinating the USEPA and IDEM's review and approval of the bid package and associated plans for the remediation activities.

IDEM Remedial Project Manager

The IDEM RPM will be responsible for overseeing the project and for conducting all IDEM reviews of the bid package and associated plans.

ERM-North Central Project Managers

Mr. David Hurst and Dr. Elsie Millano, The ERM-North Central Project Managers, are responsible for producing the bid package for the remediation of the site and the associated plans (i.e., the FSP, QAPP, and HSP), respectively.

Contractors' Project Managers

The Enviro-Chem Trustees will select separate primary contractors to perform the water sampling and remediation activities. Each contractor's Project Manager will have the overall responsibility for ensuring that the project meets the USEPA objectives and the quality standards specified in this QAPP.

The Contractors' Project Managers will: (1) acquire and apply technical resources as needed to ensure performance within budget and schedule constraints; (2) orient, direct, and monitor all field leaders and support staff; (3) review the work performed on each task to ensure its quality, responsiveness, and timeliness; and (4) be responsible for the preparation and quality of the reports submitted to the agencies.

Contractors' Field Leaders

The Contractors' Field Leaders will be responsible for leading and coordinating the day-to-day activities of the various workers and subcontractors under their supervision. Each Field Leader will be a highly experienced environmental professional and will report directly to his or her respective Project Manager. Specific responsibilities will include: (1) implementation of field-related work plans, (2) assurance of schedule compliance, (3) coordination and management of field staff, (4) compliance with QA/QC requirements described in this QAPP, (5) compliance with the corrective action procedures described in this QAPP, and (6) participation in the preparation of the final report.

Technical Staff

The technical staff for this project will be drawn from the contractors' pool of resources. The technical staff team will perform field tasks, analyze the data, and prepare the reports.

Contractors' Quality Assurance Officers

The QA Officers (QAOs) for the sampling activities at the site will have the overall responsibility for Quality Assurance. The QAOs will review and approve all reports and corrective actions related to the site; perform audits of the field activities and records; provide QA technical assistance to the technical staff; and report on the adequacy, status, and effectiveness of the QA program on a regular basis to the Contractors' Project Managers. The QAOs will also be responsible for performing the data validation.

USEPA Region V Quality Assurance Officer

The USEPA Region V QAO will have the responsibility of reviewing and approving all QAPPs.

Laboratories' Project Managers

The analyses to be performed by each laboratory are listed in Table 1-3. The laboratories' Project Managers will be responsible for coordinating and scheduling the laboratory analyses; supervising the in-house chain of custody; approving the QAPP; and overseeing the data review and preparation of the analytical reports.

Laboratories' Quality Assurance Officers

The laboratories' QAOs will be responsible for overseeing the laboratory QA and the analytical results QA/QC documentation, conducting the data review, selecting any necessary laboratory corrective actions, preparing the Standard Operating Procedures (SOPs), and approving the

QAPP and the final analytical reports. Each laboratory may have more than one QAO if, for example, any of these various activities take place in different departments within the laboratory.

USEPA Region V Central Regional Laboratory

The Laboratory Scientific Support Section of the Central Regional Laboratory (CRL) of USEPA Region V will be responsible for external performance and system audits of the analytical laboratories.

3.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for sampling, chain of custody, laboratory analyses, field measurements, and reporting that will provide data of a quality consistent with its intended use and defensible in a court of law. Specific procedures for sampling, chain of custody, laboratory and field instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of equipment, and corrective action are described in other sections of this QAPP. This section addresses the accuracy, precision, sensitivity, completeness, representativeness, and comparability of analyses.

3.1 Level of Quality Control Effort

Field blank, trip blank, field duplicate, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means of assessing the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the site that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples because of contaminant migration during sample shipment and storage. Field duplicate samples are analyzed to check for sampling reproducibility. Matrix spikes (MS) provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes for organic analyses are performed in duplicate and are hereinafter referred to as MS/MSD samples.

The general level of QC effort will include one field duplicate and one field blank for every 10 or fewer investigative samples. However, no field blanks will be collected for the soil samples, and no duplicates will be collected for the soil vapor samples. One VOC trip blank (consisting of two unopened 40-ml vials filled with distilled, deionized, ultra-pure water) will be included along with each shipment of aqueous VOC samples. Also, one VOC trip blank consisting of an activated charcoal tube will be included with each shipment of vapor VOC samples.

The general level of QC effort will also include one MS/MSD analysis for every 20 or fewer investigative samples. No MS/MSD analysis will be performed on soil samples for particle size distribution. For the water samples designated for MS/MSD analysis, triple the normal volume will be collected for VOC analysis, and double the normal volumes will be collected for samples for BNA and polychlorinated biphenyl (PCBs) analyses. For organics in soil and all inorganics designated for MS/MSD analysis, no extra sample volume is needed. Lancaster will use blank tubes for MS/MSD spiking. The number of MS/MSD, duplicate, and field blank samples to be collected are listed in Table 1-2. Sampling procedures are specified in the FSP.

If only one vapor sample is collected, no field QC sample will be submitted to the laboratory, because the sample is used only for operational control of the system and no laboratory-supplied QC samples (MS/MSD or blank tubes) will be analyzed. Also, no duplicates will be collected from the SVE system, because the sample collection process cannot be exactly duplicated. Since the on- and off-site subsurface water samples will be collected simultaneously, those samples will be grouped together to determine the number of QA/QC samples needed.

The levels of QC effort by Warzyn, EMS, Lancaster, ATEC, and IEA are outlined in their SOPs included in Appendices A.1, B, C, D, and E, respectively. The level of QC effort

provided by CompuChem will meet the requirements specified under the CLP Statements of Work (SOWs) as modified by Appendix A.8, the 1,1-DCA SOP included in Appendix A.2, and the SW-846 Method 8240 SOP in Appendix A.9.

The level of QC effort for the field measurement of pH will consist of a precalibration at the beginning of the day by using two buffer solutions and calibration verification at regular intervals (at least once each day). QC effort for field specific conductance measurements will consist of an initial calibration at the beginning of the day and continuing calibration verification (at least once each day) by using a standard solution of a known specific conductance. Appendix F contains detailed procedures for calibration and maintenance of the field equipment.

3.2 Accuracy, Precision, and Sensitivity of Analyses

The QA objectives of laboratory analyses with respect to accuracy, precision, and sensitivity are to achieve the QC acceptance criteria of the analytical protocols. Accuracy and precision requirements for CLP protocol analyses are described in the SOWs OLC01.0, OLM01.0 (with the corresponding revisions), and ILM01.0. The accuracy and precision criteria for tin, 1,1-DCA, volatiles in soil, and antimony and arsenic in water analyses are described in the respective SOPs in Appendices A.1, A.2, A.9, and E.1. Accuracy and precision criteria for vapor analysis by Lancaster are presented in Appendix C. Precision criteria for particle size distribution by ATEC is given in Appendix D. Table 3-1 summarizes the project-required detection limits for each medium sampled.

The QA objectives of field analyses with respect to accuracy, precision, and sensitivity are to achieve acceptable data, based on specified performance criteria. The project-required accuracy

TABLE 3-1

**PROJECT-REQUIRED DETECTION LIMITS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 1 of 3)**

Laboratory Parameter ⁽²⁾	Project-Required Detection Limits ⁽¹⁾			
	Soil Vapor ^(3,4) (Vppm)	Soil ^(5,6) (ug/kg)	On-Site Till Water (ug/l)	Off-Site Subsurface Water and Surface Water (ug/l)
Volatile Organics:				
Acetone	0.35	10	5	N/A
Chlorobenzene	N/A	5	1	N/A
Chloroform	0.46	5	1	1
1,1-Dichloroethane	0.32	5	0.35	N/A
1,1-Dichloroethene	0.30	5	1	1
Ethyl Benzene	0.13	5	1	1
Methylene Chloride	0.63	10	2	2
Methyl Ethyl Ketone	0.30	10	5	N/A
Methyl Isobutyl Ketone	0.22	15	5	N/A
Tetrachloroethene	0.61	5	0.6 ⁽⁸⁾	0.6
Toluene	0.21	5	1	1
1,1,1-Trichloroethane	0.40	5	1	1
1,1,2-Trichloroethane	0.40	5	0.4 ⁽⁸⁾	0.4
Trichloroethene	0.45	5	1	1
Total Xylenes	0.20	5	1	N/A
Base Neutral/Acid Organics:				
Bis(2-ethylhexyl)phthalate	N/A	N/A	1.3 ⁽⁸⁾	10
Di-n-Butyl Phthalate	N/A	N/A	10	10
Diethyl Phthalate	N/A	N/A	10	10
Isophorone	N/A	N/A	1.3 ⁽⁸⁾	N/A
Naphthalene	N/A	N/A	10	10
Phenol	0.20	330	10	10

TABLE 3-1

**PROJECT-REQUIRED DETECTION LIMITS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 2 of 3)**

Laboratory Parameter ⁽²⁾	Project-Required Detection Limits ⁽¹⁾			
	Soil Vapor ^(3,4) (Vppm)	Soil ^(5,6) (ug/kg)	On-Site Till Water (ug/l)	Off-Site Subsurface Water and Surface Water (ug/l)
Inorganics:				
Antimony	N/A	N/A	0.2	N/A
Arsenic	N/A	N/A	10	0.0120
Barium	N/A	N/A	200	N/A
Beryllium	N/A	N/A	5	N/A
Cadmium	N/A	N/A	5	N/A
Chromium VI	N/A	N/A	10	10
Lead	N/A	N/A	3	3
Manganese	N/A	N/A	15	N/A
Nickel	N/A	N/A	40	40
Silver	N/A	N/A	10	N/A
Tin	N/A	N/A	200	N/A
Vanadium	N/A	N/A	50	N/A
Zinc	N/A	N/A	20	20
Cyanide	N/A	N/A	10	
Polychlorinated Bipheynls (PCBs):	N/A	N/A	1 ⁽⁷⁾	1 ⁽⁷⁾

New As.

TABLE 3-1

**PROJECT-REQUIRED DETECTION LIMITS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
(Page 3 of 3)**

Notes:

- ⁽¹⁾ Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.
- ⁽²⁾ From Table 3-1 of Exhibit A to the Consent Decree.
- ⁽³⁾ The reporting unit is parts per million by volume (Vppm).
- ⁽⁴⁾ The detection limits shown assume a 10-liter sample volume and two 100 mg/50 mg charcoal tubes or one 100 mg/50 mg XAD-7 tube used for sampling.
- ⁽⁵⁾ The detection limits listed for soil are based on wet weight. The detection limits calculated by the laboratory for soil, on a dry weight basis as required by the contract, will be higher.
- ⁽⁶⁾ The detection limits shown for base neutral/acid organics are for low concentration soil samples. The medium concentration soil detection limits are 30 times the individual low concentration soil detection limits shown in the table.
- ⁽⁷⁾ The detection limits shown are higher than the corresponding Acceptable Concentrations specified in Table 3-1 of Exhibit A to the Consent Decree. However, in accordance with Footnote 7 of Table 3-1 of Exhibit A to the Consent Decree, if the detection limits approved by the U.S. Environmental Protection Agency (USEPA) are higher than the Acceptable Concentrations, then the Acceptable Concentrations will be met if the sample results are below the USEPA-approved detection limits (e.g., nondetected result).
- ⁽⁸⁾ These values are lower than the Contract-Required Quantitation Limits specified in the Contract Laboratory Program (CLP) Statement of Work (SOW) being used for this analysis (see Table 7-1). However, CompuChem Laboratories achieved the lower detection limits shown for these parameters during their method detection limit (MDL) study for this SOW. The reporting modifications using these MDLs are described in Appendix A.8.
- ⁽⁹⁾ The actual MDL determined by IEA, Inc. is 1.2 ug/l. However, the sample will be concentrated 100 times before analysis, making the MDL approximately 0.012 ug/l.

and precision of the field instruments are specified on Table 3-2 along with the estimated instrument accuracy and precision capabilities. The accuracy of field measurements of pH will be assessed through premeasurement calibrations and postmeasurement verifications using at least two standard buffer solutions. (The pH meter will be calibrated using two standard buffer solutions, and then the pH of both solutions will be measured.) The two measurements must each be within ± 0.10 pH units of the actual buffer solution values, or the meter will require recalibration. Precision will be assessed through duplicate measurements. (The electrode will be withdrawn, rinsed with deionized water, and reimmersed between each duplicate). The instrument used will be capable of providing measurements to 0.10 standard pH units. The duplicate measurement must be within ± 0.10 pH units of the initial measurement, or the meter will require recalibration.

The accuracy of the specific conductance meter will be assured by daily calibration verification with solutions of known specific conductance. The accuracy of the specific conductance field measurements will be assessed by premeasurement calibration of the specific conductance meter and postmeasurement verification by using solutions of known specific conductance. The measured specific conductance of the standard solution must be within 5 percent of the actual specific conductance of the solution, or the meter will require recalibration. The sensitivity of the specific conductance meter is 2.5 umhos/cm on the 0 to 500 umhos/cm range.

Sample temperature will be measured with the temperature probe on the conductivity meter. The sensitivity of this meter is 0.15° C. According to the manufacturer, the accuracy of the instrument is $\pm 0.6^\circ$ C; however, the precision of the instrument is not stated. The precision and accuracy of the temperature probe will not be verified in the field because the project-

TABLE 3-2

**PROJECT-REQUIRED ACCURACY AND
PRECISION OF FIELD INSTRUMENTS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Field Parameter	Accuracy		Precision	
	Project-Required	Instrument Capability (estimated)	Project-Required	Instrument Capability (estimated)
pH	$\pm 0.10^{(1)}$	$\pm 0.01^{(1)}$	$\pm 0.10^{(1)}$	Not specified
Specific Conductance	$\pm 5.0\%$	$\pm 3.0\%$	$\pm 5.0\%$	Not specified
Temperature	$\pm 1.0\%$	$\pm 0.6\%$	$\pm 1.0\text{ }^{\circ}\text{C}$	Not specified

Note:

⁽¹⁾ Standard pH units.

specific precision and accuracy requirements for temperature are sufficiently large that verification is not required. Furthermore, it cannot be easily performed in the field.

3.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratories will provide data meeting the QC acceptance criteria for 90 percent or better of all investigative samples analyzed, and for 100 percent of the background samples.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper selection of laboratory protocols. The sampling and analysis program is designed to provide data representative of site conditions for evaluation of the effectiveness of the remediation activities. The sampling network, which is specified in Exhibit A to the Consent Decree, was developed giving special consideration to existing analytical results from previous site investigations, the physical setting of the site, and the type of remedial activity implemented to ensure the representativeness of the data generated by the sampling activities. Representativeness will be achieved using proper sampling and handling techniques (specified in the FSP), i.e., by properly preserving the samples, extracting and analyzing the samples within the required holding times, and using clean and appropriate sample containers. The cleanliness of the sample containers will be assessed by analyzing field blanks, and the adequacy of the sampling procedures will be assessed by analyzing field duplicates.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as described in this QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

4.0 FIELD SAMPLING PLAN

The FSP, submitted as Part I of this Sampling and Analysis Plan, contains all information pertinent to the field sampling equipment and procedures.

5.0 SAMPLE CUSTODY PROCEDURES

This QAPP presents the sample custody protocols described in "NEIDC Policies and Procedures" (EPA-330/9-78-DDI-R, revised June 1985). Sample custody consists of three parts: sample collection, laboratory analysis, and final evidence files. A sample or evidence file will be considered under a person's custody if it: (1) is in a person's physical possession, (2) is in view of the person after he/she has taken possession, (3) has been secured by that person so that no one can tamper with the sample, or (4) has been secured by that person in an area that is restricted to authorized personnel. Final evidence files, including all originals of laboratory reports and field files, will be maintained in a secure area.

5.1 Field Chain-of-Custody Procedures

The field sampling and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering are included in the FSP.

5.1.1 Field Procedure

The field custody procedures to be followed by all sampling personnel include:

- o The field sampler will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible will handle the samples.

- o All samples will be tagged with sample numbers and locations.
- o Sample tags will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the ballpoint pen would not function in freezing weather.

5.1.2 Field Logbooks/Documentation

Field logbooks will provide the means of documenting the activities performed at the site. As such, entries will be in as much detail as possible so that persons going to the site could reconstruct a particular situation without relying on memory.

Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by a project-specific number.

The title page of each logbook will contain the following information:

- o Person to whom the logbook is assigned,
- o Logbook number,
- o Project name,
- o Project start date, and
- o End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site and field sampling or investigation team personnel as well as the purpose of their visit will also be recorded in the field logbook.

All measurements will be recorded and all of the collected samples will be described in the field logbook. All entries will be made in ink, and no erasures will be permitted. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is taken, a detailed description of the location, which includes compass and distance measurements, shall be recorded. The numbers of the photographs taken of the location, if any, will also be noted. All equipment used to take measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures specified in the FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, and volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field QA/QC samples, which will receive entirely separate sample identification numbers, will be noted under the sample description.

5.1.3 Transfer-of-Custody and Shipment Procedures

The transfer-of-custody and shipment procedures will be as follows:

- o Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a permanent laboratory, or to/from a secure storage area.
- o Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. Custody seals will be attached to the front right and back left of the cooler and will be covered with clear plastic tape. The cooler will be strapped shut with strapping tape in at least two locations.
- o A sample analysis request form will accompany each shipment of samples to the analytical laboratory. A description of the requested analysis and the specific laboratory analysis code will be included on this form.

5.2 Laboratory Chain-of-Custody Procedures

The specifications for chain-of-custody and document control for CompuChem, EMS, Lancaster, ATEC, and IEA are described in Attachments A.3 and A.4, B.3, C, D, and E.2, respectively. Warzyn will follow CompuChem's chain-of-custody procedures.

5.3 Final Evidence Files Custody Procedures

The contractors will maintain the Remedial Action and water sampling activity evidence files. The evidence files will include all relevant records, correspondence, reports, logs, field logbooks, laboratory sample preparation and analysis forms, data packages, pictures, subcontractor reports, chain-of-custody records, and data review reports. The evidence files will be under the custody of the Contractors' Project Managers in a locked, secure area.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

6.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. Spare electrodes and probes will be sent with each pH and specific conductance meter to be used in the field.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH meter and a specific conductance meter. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

Additionally, personal sampling pumps will be used to collect soil vapor samples. Because a contractor has not yet been selected to perform this sampling, the exact type of pump that will be used is unknown. The contractor that is selected for this task will be required to describe the calibration and operation of the sampling pumps in the contractor QAPP, which will be submitted to the USEPA and IDEM for approval.

6.1.1 pH Meter Calibration

The pH meter will be calibrated with standard buffer solutions prior to a field trip. In the field, the meter will be calibrated daily with two buffers before use, as described in Appendix F.1. Thereafter, the meter will be checked against the two buffer solutions after every five samples. Calibration procedures and frequency will be recorded in a field logbook along with the lot numbers of the buffer. The calibration procedure will be as follows:

- o Ensure that the temperature of the sample and the buffer is the same.
- o Connect the pH electrode into the pH meter, and turn on the pH meter.
- o Set the temperature setting based on the temperature of the buffer; place the electrode in the first buffer solution (pH of 7).
- o After the reading has stabilized, adjust the "CALIB" knob to display the correct value.

- o Repeat this procedure for the second buffer solution (pH 4 or 10), except use the slope adjustment knob to display the correct value.
- o Place the pH electrode in the sample, and record the pH as displayed.
- o Remove the pH electrode from the sample, and rinse off with deionized water.
- o Recalibrated the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

The calibrations performed, standards used, and sample pH values will be recorded in the field logbook. Appropriate new batteries will be purchased and kept with the meter to facilitate immediate replacement in the field as necessary.

6.1.2 Specific Conductance Meter Calibration

The conductivity cells of the specific conductance meter will be cleaned and checked against known specific conductance standards before each field trip. In the field, the instrument will be checked daily and after every five samples with National Bureau of Standards (NBS) traceable standards. The calibration procedure will be as follows:

- o Place the probe in the specific conductance calibration standard solution.

- o Set the temperature knob for the temperature of the standard solution.
- o Turn to the appropriate scale, and set the instrument for the value of the calibration standard.
- o Rinse off the electrode with deionized water.
- o Measure the specific conductance of the deionized water to be used for a field blank, making sure that the temperature is set correctly for the temperature of the solution to be tested.
- o If the specific conductance of the field blank (distilled water) is high, it must be discarded, and a new blank sample must be procured.

All readings and calibrations should be recorded in the field logbook.

6.2 Laboratory Equipment

Calibration of laboratory equipment will be based on approved, written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a repair staff with in-house spare parts or will maintain service contracts with vendors.

For the analyses conducted following the CLP protocols, the calibration procedures and frequencies specified in the applicable SOWs will be followed exactly (see Section 7.0 for the analyses to be conducted). For non-CLP analyses, the appropriate SOPs in Appendices A, B, C, and E contain the required calibration procedure, frequency, and record keeping. No equipment is used in the determination of particle size distribution.

7.0 ANALYTICAL PROCEDURES

7.1 Laboratory Analysis

Table 7-1 provides a list of the analytical methods to be followed by the laboratories for each parameter and the respective Appendix for the SOP, if applicable. Table 1-3 lists the parameters to be analyzed by each laboratory.

7.2 Field Screening Analytical Procedures

The procedures for the field measurement of pH, specific conductance, and temperature are described in the SOPs in Appendix F.

TABLE 7-1

**ANALYTICAL METHODS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA**

Page (1 of 2)

Sample Matrix	Laboratory Parameter ⁽¹⁾	Analytical Method ⁽²⁾	SOP Included in Appendix No.
Soil Vapor	Volatile Organics	NIOSH Methods 1003, 1005, 1015, 1022, 1300, 1500, and P&CAM 127	C
	Phenol	OSHA 32	C
Soil	Volatile Organics	SW-846 Method 8240	A.9
	Phenol	CLP SOW OLM01.0 ⁽³⁾	—
	Particle Size	ASTM D-422-63	D
On-Site Subsurface Water and Background-Only Subsurface Water	1,1-DCA	SW-846 Method 8010	A.2
	Other Volatiles	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	BNAs	CLP SOW OLM01.0-modified ⁽⁴⁾	—
	PCBs	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	Chromium VI	SW-846 Method 7196	B
	Tin	SW-846 Method 6010	A.1
	Antimony	USEPA Method 200.8	E
	Other Metals	CLP SOW ILM01.0	—
	Cyanide	CLP SOW ILM01.0	—
Surface Water and Investigative-Only Subsurface Water	Volatile Organics	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	BNAs	CLP SOW OLM01.0	—
	PCBs	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	Chromium VI	SW-846 Method 7196	B
	Arsenic	USEPA Method 200.8	E
	Other Metals	CLP SOW ILM01.0	—
	Cyanide	CLP SOW ILM01.0-modified ⁽⁴⁾	—
Off-Site Background Investigative Subsurface Water (1st year only)	1,1-DCA	SW-846 Method 8010	A.2
	Other Volatiles	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	BNAs	CLP SOW OLM01.0-modified ⁽⁴⁾	—
	PCBs	CLP SOW OLC01.0-modified ⁽⁴⁾	—
	Chromium VI	SW-846 Method 7196	B
	Tin	SW-846 Method 6010	A.1
	Arsenic, Antimony	USEPA Method 200.8	E
	Other Metals	CLP SOW ILM01.0	—
	Cyanide	CLP SOW ILM01.0	—

TABLE 7-1

ANALYTICAL METHODS
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA
Page (2 of 2)

Notes:

- ⁽¹⁾ The specific parameters to be analyzed for each matrix are listed in Tables 1-4 through 1-7.
- ⁽²⁾ NIOSH = "NIOSH Manual of Analytical Methods," National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, 1989 and April 1977.
- OSHA = Occupational Safety and Health Administration, (OSHA) Analytical laboratory, "Phenol and Cresol," November 1981.
- CLP SOW = Contract Laboratory Program Statement of Work.
- ASTM = "Annual Book of ASTM Standards," American Society for Testing and Materials, 1990.
- SW-846 = "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd Edition, December 1987.
- USEPA = "Determination of Trace Elements in Water and Waste by Inductively Coupled Plasma - Mass Spectroscopy," EPA Method 200.8, August 1990.
- ⁽³⁾ The analysis will be conducted following the protocols in the CLP SOW OLM01.0 and corresponding revisions.
- ⁽⁴⁾ The CLP SOWs will be modified as described in Appendix A.8.

Key:

1,1-DCA = 1,1-Dichloroethane
BNAs = Base Neutral/Acids
PCBs = Polychlorinated Biphenyls
P&CAM = Physical and Chemical Analytical Methods

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 Field Sample Collection

All the field QC will be carried out in accordance with the procedures described in this QAPP.

Field QC will include:

- o Sample collection, including MS/MSDs, field duplicates, field blanks, and trip blanks as specified in Section 3.0 for use in the assessment of precision and accuracy, according to the sampling procedures established in the FSP.
- o Proper decontamination of sampling equipment after each use, as described in the FSP.
- o Proper calibration of the field instruments, as established in Section 6.1 of this QAPP.

8.2 Field Measurements

QA for field measurements of pH, temperature, and specific conductance will be maintained through proper calibration and replication of measurements to ensure reproducibility.

8.3 Laboratory Analyses

The laboratories will implement a QA program and QC checks to ensure the generation of analytical data of known and documented usable quality.

8.3.1 Quality Assurance Program

The laboratories have written QA/QC programs that provide rules and guidelines to ensure the reliability and validity of work conducted at each laboratory. Compliance with the QA/QC program is coordinated and monitored by a QAO at each laboratory, who is independent of the operating departments. Internal QC procedures for analytical services will be conducted by the laboratories in accordance with the corresponding CLP SOW or SOP requirements.

8.3.2 Quality Control Checks

The laboratory QC checks include analyzing sample spikes, surrogate spikes, reference samples, controls, and/or blanks. The frequency of QC checks, the compounds to be used for spikes, and the QC acceptance criteria are described, as appropriate, in the CLP SOWs or the SOP for each analytical method.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Procedures for documenting sample collection and custody, validating analytical data, and reporting the results of the remediation activities are covered in this section.

9.1 Data Reduction

9.1.1 Field Measurements and Sample Collection

Field measurements and sample collection data will be recorded in the field logbook. If these data are to be used in the project reports, they will be reduced and summarized, and the method of reduction will be documented in the specific report. Sample custody and analysis requests will be documented on chain-of-custody records and sample analysis request forms.

9.1.2 Laboratory Services

Analytical data reduction will be carried out by each laboratory on its respective data sets. The data reduction will be reviewed and checked as part of the data validation. This will ensure that the actual quantities reported are accurate and appropriately qualified. Compounds detected in blanks will not be subtracted from analytical results of investigative samples and will be reported separately.

With the exception of the non-CLP analyses, the data reduction for the water and soil analyses will follow the appropriate CLP SOWs specified in Section 7.0. The data reduction procedures for the analysis of non-CLP parameters are described in the SOPs included in Appendices A.1,

A.2, B.5, and E.3. The procedure for data reduction of the soil vapor analyses is described in Appendix C. Appendix D contains a description of data treatment for particle size distribution analysis.

9.2 Data Validation

CompuChem, Warzyn, EMS, Lancaster, ATEC, and IEA will perform in-house analytical data validation under the direction of the respective laboratory QAOs. The laboratory review will include checks for the attainment of QC criteria as outlined in CLP procedures and the SOPs, as appropriate. The validity of analytical data will also be assessed by comparing the analytical results of duplicate, MS/MSD, and blank samples.

Additionally, the laboratories will critique their own analytical programs by using spiked addition recoveries, established detection limits, and precision and accuracy control charts (for CompuChem only) and by keeping accurate records of the calibration instruments. The data validation procedures to be followed by the laboratories are included in Appendices A.5, B.5, C, and E.3. Data validation of the particle size distribution analysis will consist of a check for transcription errors.

The Contractors' QAOs will conduct independent data validation of the laboratory analytical results in accordance with the procedures established in the most current USEPA data validation guidelines for the analyses conducted following CLP procedures. For the non-CLP analyses, the independent data validation will be accomplished by comparing the contents of the data packages and the results of the spike, duplicate, and blank samples to the requirements for accuracy, precision, sensitivity, and completeness specified in Section 3.0 of this QAPP. Raw

data, such as gas chromatography (GC) chromatograms and data station printouts will be examined to ensure that the reported results were accurately transcribed.

In addition, the independent validation will include: (1) an assessment of whether the samples were properly collected and handled according to the FSP and Section 5.0 of this QAPP, and (2) the identification of any out-of-control data points and data omissions to determine the need to interact with the laboratory to correct data deficiencies.

Finally, the Contractors' QAOs will evaluate the data to determine whether they are "confirmed" data. Section 3.3 of Exhibit A to the Consent Decree specifies the use of "confirmed" analytical results to prove compliance. The term "confirmed" permits the Enviro-Chem Trustees to demonstrate that an analytical result is not accurate as a result of errors in sampling, analysis, or evaluation, or that it otherwise mischaracterizes the concentration of a parameter. As specified in Exhibit A to the Consent Decree, the procedures used to obtain "confirmed" data will include re-analysis (within the required holding time), re-sampling, and the analysis of undiluted samples if a concentration is qualified by the laboratory with a "J" (estimated concentration). In addition, if the concentration of a parameter is still qualified with a "J" after re-analysis and/or re-sampling with an undiluted sample, then the results produced from undiluted samples will be used. Finally, "B" qualified analytical organic results will be considered as "confirmed" data only if the concentrations in the sample exceed 10 times the maximum amount detected in any blank for the media being analyzed.

9.3 Reporting

Warzyn, EMS, Lancaster, ATEC, and IEA data package contents are described in Appendices A.1, B, C, D, and E.1, respectively. CompuChem will provide and retain full analytical and QC documentation similar to that required by the CLP for the analyses to be conducted following CLP protocols (with the modifications described in Appendix A.8) and will provide the data package indicated in Appendix A.2 for the 1,1-DCA analytical results and Appendix A.9 for volatile organics in soil results. The retained CLP analysis documentation need not be hard copy (paper), but may be in other storage media (e.g., magnetic tape).

CompuChem will report the analytical data along with QC data and will provide the following information to the Contractor in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;
- Tabulated results of the inorganic and organic compounds shown in Tables 1-5 through 1-7 that are identified and quantified;
- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, standard procedural blanks, laboratory control samples, and Inductively Coupled Plasma (ICP) interference check samples;

- Tabulation of instrument detection limits for inorganics; and
- Raw data system including the GC chromatogram and mass spectra printouts or legible photocopies identifying the date of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes, and control samples.

All of these analytical data will be computerized in a format organized to facilitate data review and evaluation. The data set will include the data flags provided by the laboratories as well as additional flags assigned during the independent data validation. The laboratory-provided data flags will include such items as: (1) concentration below detection limit, (2) estimated concentration as a result of poor spike recovery, and (3) concentration of chemical also found in laboratory bank. These items will be noted on the laboratory analytical reports as letter flags or as comments appended to the reports and will be compiled in the case narrative for each set of samples. The independent data validation flags will indicate that the data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable as a result of out-of-control QC results.

The following data packages will be submitted to the USEPA and IDEM, along with any others that they request in the future, by the contractors:

- Data packages for all samples used to verify soil cleanup as specified in Section 4.2 of Exhibit A to the Consent Decree;

- Data packages for all background subsurface and surface water samples used to modify the site-specific acceptable concentrations listed in Table 3-1 of Exhibit A to the Consent Decree, as allowed by footnotes (2) and (4); and
- Data packages for all samples collected for post-soil clean-up compliance monitoring as prescribed in Section 4.3 of Exhibit A to the Consent Decree.

10.0 PERFORMANCE AND SYSTEM AUDITS

The Contractors' QAOs for the Enviro-Chem Site will monitor and audit the performance of QA/QC procedures to ensure that the remediation activities are executed in accordance with the FSP and this QAPP.

10.1 Field Activities

QA audits of field measurements, sample collection, and sample custody procedures will be conducted by the QAOs or the Field Leaders on a periodic basis to document that field activities are performed in accordance with the FSP and this QAPP. These audits will be scheduled to allow oversight of as many field activities as possible. An initial audit will be conducted at the start of the project to ensure that all established procedures are being followed. Subsequent periodic audits will be made to ensure continued quality sampling and to correct any deficiencies.

The field audits will include an evaluation of sampling methods; sample handling and packaging; equipment use; equipment decontamination, maintenance, and calibration procedures; and chain-of-custody procedures. In addition, all records and documentation procedures will be reviewed to ensure compliance with the project requirements. Any deviations from the FSP or the QAPP will be recorded in the field notebook by the person conducting the audit, who will then inform the personnel involved in the activity of the problem and notify the Field Leader for initiation of any necessary corrective action procedures.

10.2 Laboratory

At CompuChem, all laboratory performance and system audits will be carried out according to CLP requirements, which include external audits by the Region V CRL (Appendix A.6). Information on Lancaster's and IEA's audits is in Appendix C and E.4, respectively. The QA audits of Warzyn and EMS will be the responsibility of each Laboratory's QAO. No performance and system audits are required for ATEC.

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Equipment

Preventative maintenance procedures for the pH meter and specific conductance/temperature meter will be those recommended by the manufacturers. Field instruments will be checked and calibrated by the supplier prior to shipment and in the field as described in Section 6.1.

Critical spare parts such as tapes, probes, electrodes, and batteries will be kept on site to minimize instrument down time. Back-up equipment will be available by one-day shipment.

11.2 Laboratory Equipment

As part of their QA/QC program, the laboratories will perform routine preventative maintenance to minimize the occurrence of instrument failure and other system malfunctions. The laboratories will designate an internal group who will be responsible for performing routine scheduled maintenance and repairing or coordinating the repair of all instruments with the appropriate vendor. All laboratory instruments will be maintained in accordance with the manufacturer's specifications and the requirements of the specific method being employed. This maintenance program will be carried out on a regular, scheduled basis, and will be documented in the laboratory service logbook for each instrument. Routine preventative maintenance schedules are presented in Appendices A.7, B, C, D, and E.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Field Measurements

Field data will be assessed by the Field Leaders, who will review the field results for compliance with the established QC criteria as specified in the FSP and this QAPP. The accuracy of field measurements will be evaluated by using daily instrument calibration, calibration checks, and analysis of blanks. Precision will be assessed on the basis of reproducibility by collecting multiple readings for a single sample. Data completeness will be calculated by using Equation 12-1:

$$\% \text{ Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100 \quad (\text{Equation 12-1})$$

12.2 Laboratory Data

Laboratory results will be assessed for compliance with the required precision, accuracy, completeness, and sensitivity as described in the following subsections. Additional information for Lancaster is included in Appendix C.

12.2.1 Precision

The precision of laboratory analyses will be assessed by comparing the analytical results between MS/MSD samples for organic analyses, and laboratory duplicate results for inorganic analyses.

The relative percent difference (%RPD) will be calculated for each pair of duplicate analyses by using Equation 12-2:

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100 \quad (\text{Equation 12-2})$$

Where:

S = First sample value (original or MS value), and
D = Second sample value (duplicate or MSD value).

12.2.2 Accuracy

The accuracy of laboratory results will be assessed for compliance with the established QC criteria described in Section 3.0 of the QAPP by using the analytical results of method blanks, reagent/preparation blanks, MS/MSD samples, and field blanks. The percent recovery (%R) of MS samples will be calculated using Equation 12-3:

$$\%R = \frac{A - B}{C} \times 100 \quad (\text{Equation 12-3})$$

Where:

A = The analyte concentration determined experimentally from the spiked sample,
B = The background level determined by a separate analysis of the unspiked sample,
and
C = The amount of the spike added.

12.2.3 Completeness

The data completeness of laboratory analytical results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 12-1 as indicated in Section 12.1.

12.2.4 Sensitivity

The achievement of method detection limits depends on the instrument's sensitivity and matrix effects. Therefore, it is important to monitor the instrument's sensitivity to ensure the data quality through appropriate instrument performance. The instrument's sensitivity will be monitored through the analysis of method blanks, calibration check samples, and laboratory control samples.

13.0 CORRECTIVE ACTION

Corrective actions may be required for two classes of problems: sampling and analytical problems and noncompliance problems. Sampling and analytical problems may occur or be identified during the collection, handling, or preparation of a sample; laboratory instrument analysis; and data review.

For problems of noncompliance with the QAPP or the FSP, a formal corrective action program will be defined in accordance with this QAPP and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the appropriate Contractor's Field Leader or Project Manager. Implementation of the corrective action will be confirmed in writing through the same channels.

Corrective actions will be implemented and documented in the field logbook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by a stop-work order from the USEPA or IDEM.

13.1 Sample Collection/Field Measurements

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances, or suspected deficiencies of any activity or issued document by reporting the situation to the appropriate Field Leader. The Field Leader will discuss the suspected problems with the Contractor's Project Manager and QAO and if necessary with the Enviro-Chem Trustees, who will then make a decision based on the potential for the situation to affect

the quality of the data. If it is determined that the situation is a reportable nonconformance requiring corrective action, the USEPA and IDEM's RPMs will be notified, and a nonconformance report will be initiated by the Contractor's Project Manager.

The Contractor's Project Manager will be responsible for ensuring that any corrective action for nonconformances is initiated by:

- o Evaluating all reported nonconformances;
- o Controlling additional work on nonconforming items;
- o Determining disposition or action to be taken, in consultation with the Enviro-Chem Trustees if necessary and, if warranted by the situation, with the USEPA's and IDEM's RPMs;
- o Maintaining a log of nonconformances;
- o Reviewing nonconformance reports and corrective actions taken;
and
- o Ensuring that nonconformance reports are included in the final site documentation in project files.

If appropriate, the Project Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective actions for field measurements may include:

- o Repeating the measurement to check the error,
- o Checking for all proper adjustments for ambient conditions such as temperature,
- o Checking batteries,
- o Checking the calibration of the instrument,
- o Recalibrating the instrument,
- o Replacing the instrument or measurement devices, and
- o Stopping work (if necessary).

The Field Leader will be responsible for all site activities. In this role, the Field Leader may have to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the Field Leader will notify the Contractor's Project Manager of the anticipated change and will implement the necessary changes after obtaining the approval of the agencies. The change in the program will be documented on a Corrective Action Request

(CAR) form that will be signed by the Field Leader. The CARs will be numbered serially, as required, and will be attached to the file copy of the affected document. The USEPA and IDEM's RPMs must approve the change in writing or verbally prior to field implementation, if feasible. Otherwise, the action taken during the period of modification will be evaluated to determine the significance of any departure from established program practices or the actions taken.

The Contractors' Project Managers are responsible for controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties, including the USEPA and IDEM's RPMs. The RPMs will be notified whenever program changes are made in the field.

13.2 Laboratory Analyses

Corrective actions at the laboratories will be required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken will be somewhat dependent on the analysis and the event. Laboratory personnel will be alerted that corrective actions may be necessary if:

- o QC data are outside the warning or acceptable windows for precision and accuracy,
- o Blanks contain target analytes above acceptable levels,

- o Undesirable trends are detected in spike recoveries or in the %RPD between duplicates or MS/MSDs,
- o Unusual changes in detection limits are identified,
- o Deficiencies are detected by the QA department during internal or external audits or from the results of performance evaluation samples, or
- o Inquiries concerning data quality are received.

Corrective action procedures will often be handled at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors; check the instrument calibration, spike and calibration mixes, and instrument sensitivity; and conduct other QA/QC reviews. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor, Project Manager, and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure will be filed with the QA department. If the problem requires re-sampling or is not correctable in the laboratory, the laboratory QAO will notify the Contractor's Project Manager. The Contractor's Project Manager will decide, in consultation with the Enviro-Chem Trustees and (if warranted by the significance of the problem) with the USEPA and IDEM's RPMs, the corrective actions to be implemented. Further information on CompuChem's, Lancaster's, and IEA's corrective action procedures are described in Appendices A.6, C, and E.5, respectively.

14.0 QUALITY ASSURANCE REPORTS

Quality Assurance reports will be issued by the Enviro-Chem Trustees' Contractors as part of the remediation activity reports. These documents will: (1) contain information that summarizes the QA activities in both the field and the laboratory, including audit results; (2) discuss any quality issues that required corrective action and document the corrective action that was taken; and (3) note any project problems that have occurred and any QA/QC issues that have been satisfactorily completed. Any problem serious enough to require significant actions (e.g., changing an approved SOP) will be reported to the USEPA and IDEM's RPMs within five days of the occurrence.

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